C. CARBOHYDRATES (carbo = CARBON, hydrate = WATER) P.55

1. Made of carbon, hydrogen and oxygen, with H to O in 2-1 ratio
2. Building blocks (MONOMERS) are MONOSACCHARIDES
3. General formula for the monomers is $(CH_2O)_n$ where n is any whole number from 3-8

4. Different Types of Carbohydrates

a. Monosaccharides (Simple Sugar) (3-8 C skeleton)

1) Can be in STRAIGHT form or RING form)
2) Source of ENERGY
3) -ose ending for sugar
4) Pentoses (5 C) formula $C_5H_{10}O_5$

a) Ribose in RNA
b) Deoxyribose in DNA

5) Hexoses (6 C) formula $C_6H_{12}O_6$

a) GLUCOSE in blood, cell's main energy source
b) FRUCTOSE in fruit (sweetest of monomers)
c) GALACTOSE in milk
d) All have the same molecular formula but different STRUCTURES to determine properties = ISOMERS

6) Biological importance - sugars + phosphates = SUGAR PHOSPHATES = Glucose-6-phosphate

b. Disaccharides (DOUBLE SUGAR) $C_{12}H_{22}O_{11}$

1) Two monosaccharides Condense to form DOUBLE sugar
2) Examples

a) SUCROSE (TABLE sugar) from sugar cane or beets); glucose and fructose
b) LACTOSE = glucose + galactose - in MILK
c) MALTOSE = glucose + glucose - in MALT

2) Formed by DEHYDRATION synthesis

$$C_6H_{12}O_6 + C_6H_{12}O_6 = C_{12}H_{22}O_{11} + H_2O$$

3) Actually PHOSPHORYLATION - molecules joined with removal of phosphate
4) Bond called GLYCOSIDIC bond C-O-C
5) Function - QUICK ENERGY

3) Hydrocarbon end is NONPOLAR and does not interact with water - HYDROPHOBIC

4) Saturated - Carbon atoms with 4 atoms covalently bonded
(CH CH CH ... COOH)
3 2 2

5) Unsaturated - Carbon not bonded to the MAXIMUM number of atoms (there are DOUBLE bonds) that causes a KINK in the chain so they ARE NOT SOLID at room temperature
(CH CHCH ... COOH)
3

6) Formed by dehydration synthesis forming an ESTER bond between the glycerol and fatty acid

5. Complex lipids

a. Divided into categories according to structure - 3 classes of lipids important to living things containing fatty acids

1) TRIGLYCERIDES

a) 3 molecules of fatty acids joined to 1 molecule of GLYCEROL

b) Saturated have saturated FATTY ACID

(1) Have high MELTING points, SOLID at room temperature

(2) ANIMAL FAT, SHORTENING -

c) Unsaturated have unsaturated fatty acids

(1) LIQUID at room temperature

(2) Primarily in PLANTS (seeds, fruits) (energy for SPROUTING); energy STORAGE in animals

2) PHOSPHOLIPIDS

a) 2 rather than 3 fatty acids joined to a glycerol

b) CELL MEMBRANE is composed of layers of phospholipids (lipid BILAYER)

c) The inability of lipids to dissolve in water allows the membrane to form a BARRIER between the inside and and outside of the cell - STABLE and effective barrier for cell

3) WAX

a) Long fatty acid chain joined to an ALCOHOL chain

b) Highly WATERPROOF and plants form a protective COATING on the outer surface

6. Two amino acids join when chemical bond forms between CARBOXYL group and AMINE group = PEPTIDE bonds

7. Protein structure - CONFORMATION

   a. Primary structure - way the AMINO ACIDS are lined up; dictated by your GENES (called POLYPEPTIDE)

   b. Secondary structure - two different shapes

      1) Alpha helix - COIL / SPIRAL

      2) Beta pleated - formed due to HYDROGEN bonding between functional groups - folds back and forth so it goes UP and DOWN

   c. Tertiary structure - determines its function

      1) Bonding due to SIDE CHAIN or R groups
      2) Four types of bonds help them keep shape

         a) IONIC
         b) HYDROGEN
         c) HYDROPHOBIC
         d) DISULFIDE - stronger covalent

   d. Quartenary structure

      1) Only get this if there is more than one polypeptide CHAIN
      2) Examples

         a) Collagen - makes skin ELASTIC - 3 chains
         b) Hemoglobin - 2 ALPHA and 2 BETA held together by flexible regions of chains

8. Denaturing of proteins

   a. Protein that has LOST active conformation or shape
   b. Can be denatured by

      1) HIGH temperature
      2) HIGH salt concentration
      3) STRONG acids (pH can change shape of enzyme)

   c. Can be RENATURED if only a FEW bonds have been broken so protein can RETAIN conformation

9. Types of Proteins

   a. Enzymes - organic CATALYST - lowers activation energy requirement

      1) SPEED UP reactions - have a SPECIFICITY - specific for one substance

c. Hormones

1) Produced at one site - FUNCTION at another
2) SMALL amount to bring about a response
3) Examples - INSULIN, THYROXIN, EPINEPHRIN

d. Structural Proteins

1) Build body and cell parts
2) Examples

a) Tubulin - _____

b) Actin & Myosin - _____

c) Keratin - IN HAIR & NAILS

d) Myoglobin - _____

e) Collagen - ELASTICITY IN SKIN

f) Cytochromes - _____

g) Histones - _____

F. NUCLEIC ACIDS

1. Large, complex organic compounds that STORE INFORMATION in cells, using a system of four compounds to store HEREDITARY information, arranged in a certain order as a CODE for genetic instructions of the cell

2. Elements - carbon, hydrogen, oxygen, NITROGEN, PHOSPHORUS

3. Building blocks - NUCLEOTIDES: made of

a. Acid - PHOSPHATE

b. Sugar - DEOXYRIBOSE or RIBOSE

c. Nitrogen base

1) Purines - 2 RING

a) ADENINE
b) GUANINE

2) Pyrimidines - 1 RING

a) CYTOSINE
b) DNA only - THYMINE RNA only - URACIL

d. Parts combine, in DNA to form a DOUBLE HELIX or TWISTED LADDER; in RNA SINGLE HELIX